SPECTROSCOPIA MOLECULAR

Un bulletin mensual de novas e informationes de interesse e valor al spectroscopistas molecular

Volumine 2 --- Decembre 1953 --- Numero 20

KARL WILHELM FRITZ KOHLRAUSCH

KARL WILHELM FRITZ KOHLRAUSCH nasceva le 6 de julio 1884 in Gstettenhof proxime a Türnitz in Basse Austria como filio del chimista agricole Dr. Otto Kohlrausch e Amalie Kohlrausch, nate Bartl. Su granpatre, Rudolph Kohlrausch (collaborator con Wilhelm Weber in le determination ben-cognoscite del "numero Weber"), como etiam su oncle e patrino Friedrich Kohlrausch, jam habeva ben-respectate nomines in physica. Ille mesme esseva maritate depois 1910 a Vilma Kohlrausch, nate Norer, e esseva le patre de tres filias.

Post attender le gymnamium in Vienna e Baden (proxime a Vienna), ille esseva depois 1903 un studente in le facultate philosophic del universitate Vienna ubi ille assisteva a conferentias in mathematica e physica per Escherich, Wirtinger, Mertens; e per Lang, Exner, Boltzmann, e Hasenohrl. In maio 1907, ille recipeva le grado de Doctor de Philosophia super le base de su labor super electricitate atmospheric. Tunc ille esseva un assistente sub F. Exner al secunde instituto physic del universitate Vienna e ille se habilitava in physica in 1911.

Durante le prime guerra mundial, ille esseva un locotenente in le artilleria de campania e obteneva un dismission medical a causa de un defecto del aure obtenite in le campo (1916). Ille esseva decorate pro bravura con le medalia de argento de secunde classe, e con le cruce Karl-Troup.

In le sequente periodo, ille esseva active como privatdozent e assistente al universitate Vienna, dozent honorari al Kunstgewerbeschule como etiam al le academia de musica in Vienna, e como collaborator scientific al graphic Lehr- und Versuchsanstalt in Vienna. In 1919, ille recipeva le titulo de "professor extraordinari" e in 1920 ille acceptava un invitation como professor ordinari e chef del departimento de physica (Lehrkanzelvorstand für Physik) al Technische Hochschule in Graz. Ab 1922 a 1923 e ab 1946 a 48, ille esseva decano del facultate technologic e ab 1923 a 1924 ille teneva le officio de rector.

Su campos de activitate esseva principalmente electricitate atmospheric, radioactivitate, colorimetria, optica geometric, e le studio de structura molecular per medio del spectros vibrational observate in le effecto Raman.

Ille es autor del sequente libros e articulos in manuales:

(1) con Schweidler: Electricitate atmospheric; Graetz, Manual de electricitate e

(continuate a pagina 55, columna 1)

IE UNIVERSITATE HA DUO responsabilitates verso le scientista -- duo responsabilitates le quales illes qui supporta universitates per benefaction o action public debe in un simile maniera in alicun modo arrivar plus plenmente a apprender e comprehender:

Primo e ante toto, le universitate debe essayar a fornir le scientista con le ressources pro su labor -- laboratorios, equipamentos, assistentes, e tempore. Isto significa moneta.

Secundemente, illo debe le dar le climate de libertate -- le atmosphera de independentia a vader su proprie via productive, a seliger e a propulsar le problemas de su selection, a cercar liberemente e sin timor, a communicar su conclusiones rationate sin restriction.

-- JAMES L. MORRILL, Presidente del Universitate Minnesota.

TRACTAMENTO DEL COORDINATAS NORMAL DE MOLECULAS POLYATOMIC

Salvador M. Ferigle e Alfons Weber

(continuate ab Spec. Mol. 2 49 (1953))

3.0 LE EXPRESSION PRO LE ENERGIA CINETIC

LE ENERGIA vibrational cinetic de un molecula polyatomic es date per le formula

$$2T = \sum_{a=1}^{N} m_a \dot{\underline{d}}_a^2, \qquad (1)$$

ubi m_a es le massa e $\underline{d}_a$ le displaciamento del atomo "a" describite in un tal maniera que le conditiones Eckart es satisfacite; le derivativos de tempore debe esser prendite in le system movente, e le summa es extendite al atomos N del molecula. Eq. 1 pote esser scribite como un forma quadratic del coordinatas generalisate le quales describe le vibration, como essera demonstrate infra.

3.1 Le vectores $\underline{s}$

Si un atomo es displaciate in un tal maniera que su position relative con respecto al altere atomos es cambiate, fortias de restitution appare le quales face le displaciamento ab le configuration de equilibrio devenir parve. Nos ha necessitate de 3N - 6 coordinatas generalisate pro describer iste motion vibrational le quales essera designate per R^j (j = 1, 2, ... 3N - 6). Proque le configuration devia solo un pauc ab le configuration de equilibrio, le vectores de displaciamento essera functiones linear del R^j. Proque le 3N componentes del vectores de displaciamento non es independente -- illos es relatate per le conditiones Eckart -- le R^j pote esser obtenite in terminos del vectores de displaciamento como

$$R^j = \sum_a \underline{s}_a{}^j \cdot \underline{d}_a , \qquad (2)$$

ubi $\underline{d}_a$ es le vector de displaciamento del atomo a. Nos ha, ergo, un vector $\underline{s}$ que es associate a cata coordinata R^j e a cata atomo.

Le vectores $\underline{s}$ pro le communmente usate coordinatas interne nunc essera obtenite. Le sequente nomenclatura essera usate:

Q_{ij} : Reciproc del distantia de equilibrio inter le atomos i e j;

q_{ij} : Cambiamento in le distantia ligaminic inter le atomos i e j ab le valor de equilibrio;

$\phi_{jk}{}^i$: Valor de equilibrio del angulo con le atomo i al apice e le atomos j e k al punctos terminal del ligamines;

$\alpha_{jk}{}^i$: Cambiamento in le angulo interligaminic j-i-k ab le valor de equilibrio;

$\underline{e}_{ij}$: Un vector unitari secundo le ligamine i-j con su origine al atomo i;

$\underline{f}_{jk}$: Un vector unitari in le plano i-j-k le qual es perpendicular al ligamine i-j e es dirigite verso le atomo k.

Pro parve displaciamentos del atomos ab le positiones de equilibrio, le sequente relationes approximative date per Eliashevich[13] seque ex consideratione geometric:

$$\left.\begin{aligned} q_{ij} &= \underline{e}_{ij} \cdot (\underline{d}_j - \underline{d}_i), \\ \alpha_{jk}{}^i &= Q_{ij}(\underline{d}_i - \underline{d}_j) \cdot \underline{f}_{jk}{}^i \\ &\quad + Q_{ik}(\underline{d}_i - \underline{d}_k) \cdot \underline{f}_{kj}{}^i. \end{aligned}\right\} \qquad (3)$$

Ex Eqs. 2 e 3, on obtene

$$\left.\begin{aligned} \underline{s}_i(q_{ij}) &= -\underline{e}_{ij} = \underline{e}_{ji}, \\ \underline{s}_j(q_{ij}) &= \underline{e}_{ij}, \\ \underline{s}_j(\alpha_{jk}{}^i) &= -Q_{ij}\,\underline{f}_{jk}{}^i, \\ \underline{s}_k(\alpha_{jk}{}^i) &= -Q_{ik}\,\underline{f}_{kj}{}^i, \\ \underline{s}_i(\alpha_{jk}{}^i) &= Q_{ij}\,\underline{f}_{jk}{}^i + Q_{ik}\,\underline{f}_{kj}{}^i. \end{aligned}\right\} \qquad (4)$$

Quando le nucleos non es collinear, on obtene

$$\left.\begin{aligned} \underline{f}_{jk}{}^i &= (\underline{e}_{ik} - \underline{e}_{ij}\cos\phi_{jk}{}^i)/\sin\phi_{jk}{}^i, \\ \underline{f}_{kj}{}^i &= (\underline{e}_{ij} - \underline{e}_{ik}\cos\phi_{jk}{}^i)/\sin\phi_{jk}{}^i. \end{aligned}\right\} \qquad (5)$$

Substitution de Eqs. 5 in Eqs. 4 duce al vectores $\underline{s}$ date per Wilson[1]:

$$\underline{s}_j(\alpha_{jk}{}^i) = A(\underline{e}_{ij}\cos\phi_{jk}{}^i - \underline{e}_{ik}),$$

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[13] M. Eliashevich, Compt. Rend. Acad.Sci. U. R. S. S. 28, 604 (1940).

$$s_k(\alpha_{jk}^{\,i}) = B(e_{ik}\cos\phi_{jk}^{\,i} - e_{ij}),$$
$$s_i(\alpha_{jk}^{\,i}) = C\left[Q_{ij}(e_{ik} - e_{ij}\cos\phi_{jk}^{\,i}) + Q_{ik}(e_{ij} - e_{ik}\cos\phi_{jk}^{\,i})\right], \quad (6)$$

ubi

$$A = Q_{ij}/\sin\phi_{jk}^{\,i},$$
$$B = Q_{ik}/\sin\phi_{jk}^{\,i},$$

e

$$C = 1/\sin\phi_{jk}^{\,i}.$$

Le caso de moleculas linear, le qual ha essite studiate per Ferigle e Meister[7], essera considerate plus tarde.

(Va continuar in un numero futur.)

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KOHIRAUSCH

(continuate ab pagina 53)

magnetismo III, Barth, Leipzig, 1931;
(2) Radioactivitate, Dictionario manual de physica, Springer, Berlin, prime edition, 1924; secunde edition, 1931;
(3) Problemas del radiation gamma, Vieweg, 1927;
(4) Radioactivitate, Manual pro physica experimental, volumine 25, 1928;
(5) Le Effecto Smekal-Raman, Springer, Berlin, 1930;
(6) Volumine supplementari a isto, Springer, Berlin, 1938;
(7) Spectros Raman, Manual e annual de physica chimic, volumine 9/VI, Akad. Verlagsges., 1943;
(8) Seligite capitulos in le Lehrbuch der Physik, Springer, Vienna; Mechanica, 1947; Optica, 1948; Calor, 1948; Electricitate, 1948; e Structura de Materia, 1949.

In plus, il es a notar proxime a 200 articulos in jornales, principalmente super le effecto Raman. Como resultato de su investigationes in iste campo, ille ha recipite fama international. Le libros mentionate supra es obras standard de spectroscopia molecular.

Pro su recercas, ille recipeva in 1920 le medalia Voigtländer de argento, in 1922 le precio Lieben, e in 1928 le precio Haitlinger del academia de scientias in Vienna. In 1929 ille esseva eligite membro correspondente del academia de scientias de Vienna. In 1938 ille deveniva un membro ordinari del academia de scientistas natural in Halle, in 1939 membro ordinari del austriac academia de scientias, e in le mesme anno un membro honorari del indian academia de scientias in Bangalore. In 1942 ille deveniva un membro correspondente del academia royal de scientias in Bologna, in 1952 membro honorari del societate de chimistas austriac, e in 1953 chef honorari del austriac societate physic.

Post multe annos de pena, professor Kohlrausch moriva de cancere le 17 de septembre 1953 in Graz.

J. Wagner

Physikalisches Institut
der Technischen Hochschule
Graz, Austria

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LIBROS

Le Structura de Moleculas Librere. Per H. A. Stuart. In germano. 609 paginas, 189 illustrationes. Indices de nomines e del materias. Springer-Verlag; Berlin, Göttingen, Heidelberg; 1952. Precio, ligate in lino DM 69 (circa $17.00).

ISTE LIBRO ES LE prime volumine de un serie super le physica del alte-polymeros que va esser redigite per H. A. Stuart. Illo tracta del methodos physic general pro le determination del structura de moleculas e lor characteristicas importante.

Discutite es: fortias de valentia e fortias intermoleculari; dimensiones e forma del moleculas; determination spectroscopic del momentos de inertia e del distantias internucleari; le movibilitate interne del molecula e su structura; le constante dielectric, le momento electric, e structura molecular; diffusion de lumine, polarisabilitate, e structura molecular; duple refraction electric, anisotropia, e structura molecular; vibrationes characteristic del molecula; e le absorption de lumine e le constitution del specimen. Le libro contine 129 tabulas.

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Vibrationes Molecular (Kolebania molekul). Per Volkenshtein, Yelashevich, e Stepanov, volumines I e II, Moscow e Leningrad, 1949. Probabilemente disponibile via Stechert-Hafner, Inc., 31 East 10th Street, New Yoek 3, New York.

ARTICULOS RUSSE

Traductiones in anglese del sequente articulos ex Doklady Akademii Nauk SSSR es disponibile ab le Office of Technical Services, Department of Commerce, Washington 25, D. C. a un precio de $0.10 per cata un:

1) Un methodo optic pro le studio del hydrogenos de silicon; spectros Raman del alkenysilanos; Yu. P. Yegorov e P. A. Bazhulin, 88, 647-50 (1953); NSF-tr-69;

2) Spectros de transmission de filmes vitrose de silicato magre in le infrarubie; V. A. Florinskaya e R. S. Pechenkina, 89, 37 (1953); NSF-tr-30;

3) Le elimination del coordinatas dependente in le theoria del vibration de moleculas polyatomic; L.S. Mayants, 89, 423 (1953); NSF-tr-37;

4) Isomerismo rotational de 1,2- dichloroethano e 1,2-dibromoethano; Yu.A.Pentin, Yu. S. Bobovich, D. B. Gurevich, e V. M. Tatevsky, 89, 435 (1953); NSF-tr-38;

5) Le longitude del catena molecular de cis- e trans-polydieno; A. A. Chistorazum, 89, 999-1002 (1953); NSF-tr-61; e

6) Le spectro infrarubie de absorption de aqua liquide in le region de 3200-3600 K (K = kaysers = cm^{-1}); S. N. Andreyev e T. G. Balicheva; 90, 149-51 (1953); NSF-tr-66.

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K o cm^{-1}; σ o ν?

Le commission juncte pro spectroscopia ha recommendate le uso de K (kaysers) e σ in loco de cm^{-1} e ν pro le unitate de numero de undas e pro le numero de undas, respectivemente (vide Spec. Mol. 2, 45 (1953); J. Opt. Soc. Am. 43, 410 (1953)).

Plure spectroscopistas ha essite invitate a commentar re iste recommendation a fin de facilitar su adoption universal, o su revision. Dr. G. Herzberg ha autorisate le publication del sequente notitia a condition que il es clarmente indicate que illo es le opinion de minoritate de un membro del commission juncte qui non poteva esser presente al session in Roma. Illo es un portion de un littera scribite per Dr. Herzberg al secretario del commission juncte.

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Un Opinion de Minoritate

Io da le benvenita al introduction del nomine kayser pro le unitate de numero de undas, sed io es curiose re le ration que un K esseva recommendate como un abbreviation proque K es usate como un abbreviation pro grado Kelvin. In spectroscopia molecular il occurrera toto frequentemente que grado Kelvin es usate in le mesme paragrapho como cm^{-1}, i. e. kayser. Ergo io haberea preferite k pro kayser.

Io debe admitter que io ha un pauc inquietude re le recommendation de usar σ pro numero de undas in loco de ν. Ben que io certemente admitte que in theoria isto es un multo bon innovation, io senti plus tosto incerte super le practica. Personalmente io crede que il haberea essite mellor si le symbolo pro frequentia habeva essite cambiate plus tosto que le symbolo pro numero de undas, si un cambiamento esseva considerate como necessari. Como un exemplo del consequentias, io mentiona que si io voleva poner mi duo libros in conformitate con le recommendation il haberea milles de cambiamentos de ν a σ, durante que si le symbolo de frequentia habeva essite cambiate il haberea solmente cinque o dece cambiamentos. In plus, il pare a me que le uso de ν_i, per exemplo, pro le vibrationes de un molecula polyatomic (in kaysers) es si ben establite, particularmente inter le chimistas physic le quales non es representate in le commission juncte, que io considera como extremente improbabile que omnes sequerea le recommendate cambiamento. Il ha multe altere casos in equationes standard in spectroscopia molecular (per exemplo, le origine del banda, ν_o) ubi, si on desirava esser consequente, un cambiamento deberea esser facite. Io regretta grandemente que io non esseva al session e ergo non poteva sublevar iste objectiones quando le motion esseva discutite, sed io certemente haberea votate contra le motion si io habeva essite presente. In omne caso, si iste recommendation es a ramaner il essera necessari persuader le Union International de Chimia Pur e Applicate a sequer illo, proque si non il haberea certemente un grande confusion.

G. Herzberg

Concilio National de Recerca
Ottawa 2, Canada

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Opiniones del Spectroscopistas al Instituto Technologic de Illinois

Omne le spectroscopistas al **Instituto** Technologic de Illinois es in favor del adoption immediate del symbolo K (kayser) pro le unitate de numero de undas, in loco de cm^{-1}--como recommendate per le commission juncte de spectroscopia. Isto economisarea spatia e costo de **imprimeria**, facilita le preparation de manuscriptos, e evita le occurrentia de expressiones insensate como "le numero de undas es 984,7 plus o minus 0,1 de un numero de undas". Isto devenirea "le numero de undas es 984,7 $\pm$ 0,1 K". Il pare que il haberea nulle confusion con grados Kelvin proque isto es scribite °K (per exemplo 298°K). Si k esserea usate, isto suggererea le constante Boltzmann. Nulle symbolo esserea unic. Le uso del symbolo A pro longitude de unda e pro le constante rotational non causa confusion.

Un tal unanimitate non existe re le symbolo σ pro numero de undas recommendate per le commission. Alicunes senti que le uso de ν es si universal in le spectroscopia molecular que su retention es justificate. Alteres crede que le symbolo pro numero de undas deberea esser le mesme in omne le campos ubi numeros de undas es usate (optica, theoria electromagnetic, mechanica del quantos, spectros atomic, etc.) e que un committee o commission includente representantes ex omne iste campos deberea facer le decision final, le qual tunc omnes deberea sequer.

In iste connexion, on debe notar que le symbolo σ pro numero de undas esseva seligite post un multo complete studio e post consultation con altere tal committees, per le Committee re Symbolos de Littera e Abbreviationes del Association American de Instructores Physic, e que isto esseva subsequentemente approbate per le Association American de Standardes (Vide Am. J. Phys. 16, 164-179 (1948)). Isto, plus le facto que le mesme symbolo ha essite recommendate per le commission juncte pro spectroscopia post multe studio additional, suggere que le uso de σ pro numero de undas non deberea esser levemente rejectate per spectroscopistas individual in favor de lor selection personal o lor passate uso habitual de alicun altere symbolo.

Forrest F. Cleveland

Instituto Technologic de Illinois
Chicago 16, Illinois

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Commentos de altere spectroscopistas es invitate, specialmente ab ille membros del commission juncte qui esseva presente al session in Roma e qui ergo pote explicar le rationes pro le adoption del symbolo σ.

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PROGRAMMA FINAL DEL SYMPOSIO SPECTROSCOPIC A NEW ORLEANS

Jovedi postmeridie
Le 10 de decembre 1953
Application de Spectroscopia al Agricultura e Industria del Sud
Un Symposio
Robert T. O'Connor, Presidente
Le Sala Tulane

1.00 Commentos introductori.

1.05 44. Spectroisotopia -- Applicationes de spectroscopia de alte resolution. J. Rand McNally, Jr., Laboratorio national Oak Ridge, Tennessee.

1:35 45. Spectroscopia massic. B. W. Thomas, Humble Oil and Refining Company, Baytown, Texas.

2:05 46. Spectroscopia emissionic. E. E. Creitz, Statounitesse Bureau de Minas, Universitate, Alabama.

2:35 47. Spectroscopia Raman. Forrest F. Cleveland, Instituto technologic de Illinois, Chicago 16.

3:05 48. Le spectrographia roentgenic e su usos practic. Fred A. Behr, North American Phillips Company, Mt.Vernon, New York.

3:35 49. Spectroscopia de resonantia magnetic nucleari. James N. Shoolery, Varian Associates, Palo Alto, California.

4:05 50. Spectrophotometria infrarubie. R. C. Gore, American Cyanamid Company, Stamford, Connecticut.

4:35 51. Applicationes de spectroscopia ultraviolette. Norman D. Coggeshall, Gulf Research and Development Company, Pittsburgh, Pa.

Altere discursos, non includite in le symposio, de interesse al spectroscopistas a iste conclave regional del American Chemical Society es:

118. Hyperconjugation in alicun hydrogenos de carbon terpenic. G. A. Thomas, C. E. Reed, e J. E. Hawkins, Universitate Florida, Gainesville, Florida.

125. Le spectros ultraviolette e infrarubie de alicun terpenos derivabile ab terebinthina. R. T. O'Connor e L. A. Goldblatt, Southern Regional Research Laboratory, New Orleans, Louisiana.

157. Analysatores continue applicate al operationes de fabrica pilota. K. L. Lanneau, Esso Standard Oil Company, Baton Rouge, Louisiana.

189. Investigationes de alicun complexos diborano-etherate per medio del spectroscopia Raman. B. Rice e H. Uchida, universitate St. Louis, St. Louis, Missouri.

Le total numero de discursos es 193.

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CONTRIBUTIONES FINANCIARI ADDITIONAL

Individuos: David T. Burbank, St. Louis, Missouri; Lester Corrsin, Baltimore, Maryland; e Bernard P. Susz, Universitate Geneva, Switza.

Bibliothecas: Bell Telephone Laboratories, New York; e le Hayden Library del Instituto Technologic de Massachusetts, Cambridge, Massachusetts.

Companias: Perkin-Elmer Corporation, Norwalk, Connecticut (2nde); Jarrell-Ash Company, (Newtonville, Massachusetts (2nde); e Applied Research Laboratories, Glendale, California (7te).

Costo de un numero de 5 paginas per lector per anno $2.00

Contributiones usque nunc per lector per anno $0.68

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CALENDARIO DE EVENTOS SPECTROSCOPIC

Decembre 10: Symposio al Hotel Jung in New Orleans (R. T. O'Connor, 2100 Robert E. Lee Boulevard, New Orleans 19, La.).

Junio 14-18: Symposio al universitate Ohio State (H. H. Nielsen, Columbus 10).

Julio: Symposio super "Particulas Solide in Objectos Astronomic", Universitate Liége (J. Duchesne, Liége, Belgica).

SPECTROSCOPIA MOLECULAR es publicate mensualmente in interlingua al Laboratorio de Spectroscopia, Instituto Technologic de Illinois, Chicago 16, Illinois, Statos Unite. Illo pote devenir un periodico importante si illo recipe le supporto de spectroscopistas molecular. Manuscriptos in interlingua (o anglese) debe esser submittite a Forrest F. Cleveland al adresse supra-indicate.

Le bulletin se basa super le conviction que illo recipera financiari contributiones voluntari -- sufficiente pro su crescimento e disveloppamento -- ab illes qui beneficia de illo, e ab alteres qui crede que isto es un projecto que merita lor supporto. Le natura e valor de numeros futur essera un mesura del validitate de iste hypothese.

Le texto original es legite per Dr. Alexander Gode, Chef del Division de Interlingua de Science Service (80 East 11th Street, New York 3, N.Y.) Libros importante super interlingua es Interlingua-English Dictionary e Interlingua Grammar (Storm Publishers, New York 17).

Labor editorial es gratis. Le costo de preparation e distribution es recipite ab le spectroscopistas, bibliothecas, e companias. Le directores de publication es senioretta Joyce Carol Broling e senior Fred L. Voelz.

. . . . . .

. (Face cheques pagabile a Spectroscopia Molecular; posta al supra-date adresse)

. ☐ Io include $2.00 pro Spectroscopia Molecular pro 1953, e $ ____ additional pro le disveloppamento plus rapide de illo.

. ☐ Io include $2.00 pro Nos. 1-8, 1952.

. ☐ Io include $0.75 pro Regulas de Selection pro Spectros Vibrational de Moleculas Polyatomic; 1953, 25 paginas.

. ☐ Io include $____ e 500 exemplares de un pagina de information re nostre productos pro attachamento al sequente numero. (Traduction in interlingua, si desirate, gratis per Science Service.)

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SPECTROS MOLECULAR. I.

REGULAS DE SELECTION PRO SPECTROS VIBRATIONAL DE MOLECULAS POLYATOMIC

per Forrest F. Cleveland

-ooo-

ISTE PARVE MONOGRAPHIA explica le methodos de obtener le regulas de selection pro spectros vibrational de moleculas polyatomic, e linear e non-linear. Tabulas del characteres de omne le gruppos es date, e resultatos pro le regulas de selection pro multe symmetrias es tabulate. Pro plus facile comprehension per multe spectroscopistas, le monographia esseva scribite in le lingua international, Interlingua. Illo es appropriate pro uso in seminarios, classes in structura molecular, o pro referentia. Illo etiam pote esser usate per le lector individual qui desira comprehender iste subjecto. Le tractamento es elementari e detaliate pro plus facile comprehension per le initiato in iste campo.

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1.0 Introduction
2.0 Fundamentales
2.1 Spectros infrarubie
2.2 Spectros Raman
3.0 Combinationes
4.0 Harmonicos nondegenerate
5.0 Harmonicos degenerate
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9.2 Spectros infrarubie
9.3 Spectros Raman
9.4 Combinationes
9.5 Harmonicos
10.0 Regulas de selection pro varie symmetrias
Indice de materias
Indice de autores
Indice de gruppos
Indice de moleculas

(Seca e posta a Laboratorio de spectroscopia, Cassa postal 58, Instituto technologic de Illinois, Chicago 16, Illinois, Statos Unite; face cheques pagabile a Forrest F. Cleveland. Data de publication, septembre 1953. Precio per exemplar, $0.75.)

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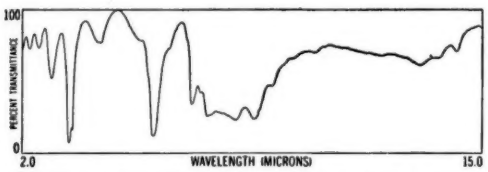

Spectrum of organic coating taken with reflectance attachment and Model 21 Spectrophotometer.

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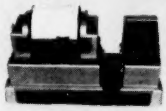

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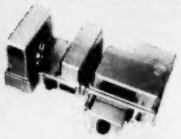

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